BLACK BOX®
NETWORK SERVICES

Models AC1120A 1121A 1122A 1123A *
16x16 and 8x8 VGA/HDTV Video Matrix Switch with Front Panel, RS232, and Optional Audio & IP Control

* **This user's manual pertains to a number of Black Box 16x16 and 8x8 video matrix switches. Some models have audio switching and IP control port, and some models do not.**

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This product complies with the requirements of the European EMC directive 89/336/EEC

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About This Manual

This user's manual covers several variations of Black Box's 8x8 and 16x16 VGA/HD matrix switches. Four configurations of the matrix are discussed in this user' manual per the table below. Since this is an all-encompassing user's manual, portions of this guide may not pertain to any specific unit.

AC1120A	8x8 VGA Matrix Switch With Serial Control
AC1121A	8x8 VGA & Audio Matrix Switch with IP and Serial Control
AC1122A	16x16 VGA Matrix Switch with Serial Control
AC1123A	16x16 VGA & Audio Matrix Switch with IP and Serial Control

*** Upon power-up the switches output a string on their RS-232 port that identifies the unit's capabilities such as: BBox-I-A-8-8 (I=IP port, A= Audio, 8-8 = number of inputs and outputs respectively)

1.0 General

The AC1120A through AC1123A are compact high-end matrix switches for video and audio. The matrices are used for cross-point switching of video and audio signals. The switch provides 8 or 16 video (and audio) outputs, each capable of independently displaying any of 8 or 16 inputs in any combination. Additionally, the outputs can be blanked out and/or muted. The Matrices can be used in TV broadcasting environments, multi-media conference halls, public facilities, large display projects, schools, courtrooms, and command & control centers.

The units are compatible with PC video from 640x480 to 1920x1600 or analog SD/HDTV Component Video (YPbPr) from 480i to 1080p. The Matrix can be controlled in 3 ways: manually using the buttons on the front panel, through one or two serial RS232 control ports, or remotely via IP port.

1.1 Features

- ✓ Allows cross-point switching of PC or HD video and audio signals
- ✓ Multiple control methods including front panel, serial and IP ports
- ✓ Switched output can be blanked or muted
- ✓ Wide bandwidth to support PC resolutions to 1920x1200 or HD to 1080p
- ✓ Balanced stereo audio outputs allow interference free connections
- ✓ VU meter (sound level) bar graph display on the front panel
- ✓ Battery-backed Real-time clock on all models with scheduling capability
- ✓ Monitors system voltage levels and temperature
- ✓ Alerts user with a blinking CHECK light if system faults are detected
- ✓ Built-in universal power supply
- ✓ Compact, Rugged, Reliable, and Economical

2.0 Installation

The matrix is housed in a 2RU 19" wide rack mountable enclosure. All of I/O, control, and the power connections are on the rear of the unit.

Figure 1 – Rear panel of AC1123A showing all the connections

2.1 Input Audio & Video Connections

Figure 2 - Audio and video inputs on AC1123A

The video connectors are HD15 female. These are compatible with PC's VGA video signal (RGBHV). The Matrix is also compatible with analog SD or HDTV signals (YPbPr) with resolutions from 480i to 1080p. To connect these types of signals to the Matrix, HD15 to 3-RCA cables may be required.

Technical Note about the Video Inputs

The HD15 inputs of the matrix handle only the color and sync signals. EDID (extended display identification data) is absent. EDID is normally used by the source PC to read pertinent information from the connected display. This information includes a list of the resolutions that are supported by the LCD. If EDID is not implemented, the source PC is unaware of the specific LCD connected to it. Generally this is not a problem since in the absence of EDID, most PC's allow the user to select from a set of default resolutions for output. Some PC's may not output any video signal, or only allow limited resolution settings with the absence of EDID . One way to resolve this is to change the display settings of the PC to show all modes and not detect Plug and Play LCD. The procedure for doing this varies depending on the operating system and the video card in the PC. It is generally found under: Control Panel > Display Settings > Advanced > Monitor tab. Alternatively a pass-through EDID emulator can be used. This a piece of hardware that is sold separately.

The audio input on the basic unit uses standard 3.5mm mini-stereo connectors. To use these with PC audio, standard male-to-male audio extension cables would be required. To connect from typical TV sources with separate right and left connectors, 3.5mm male to 2 RCA cables would be needed.

Technical Note about the Audio Inputs

Since the audio inputs are unbalanced (single ended), the ground reference of the source has to be the same as the matrix. Of course the cable connecting the two is tying the grounds across but if there are currents flowing in the ground it can create potential differences that would manifest as noise. The quality of grounding at the audio source and the matrix are important. For example if the input source is a desktop PC, as long as the PC is properly grounded and the audio cable length is not excessive, you can expect good results. On the other hand if the input is a notebook PC running on battery, there is no ground reference at the source so it gets its reference through the audio (and video) cable connection to the matrix. This should also be okay. However if it is plugged in through its external power brick, noise can be induced. This is because most notebook power supplies do not properly provide an AC ground path to the system ground (some only have only 2 prong AC cords). The switching power supply circuit will inject noise into the audio lines. In this case the solution may be to attach a low resistance ground strap to the notebook. The other option for eliminating the noise is to use a stereo audio Balun (or isolator). The Balun essentially couples the audio through a transformer so the audio grounds are isolated. Baluns can also cure noise pickup in long cable runs.

2.2 Output Audio & Video Connections
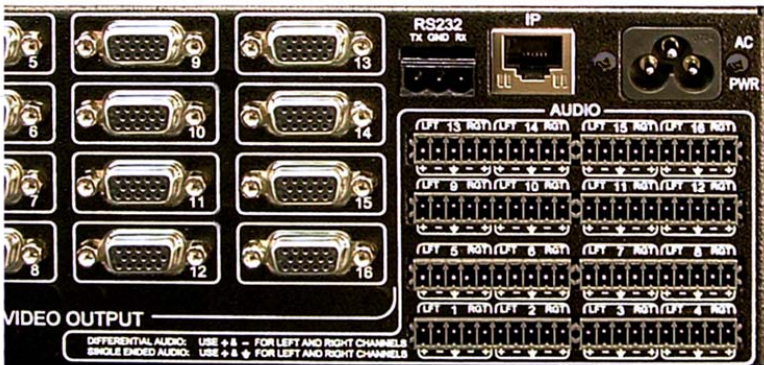
Figure 3 – Standard matrix audio and video outputs

The video output connectors are HD15 female. These are compatible with PC's VGA video signal (RGBHV). The Matrix is also compatible with YPbPr HDTV signals with the use of HD15 to 3 RCA adapter cables.

The audio outputs of the matrix are balanced. So a + and a – are provided for each side. There is also a ground connection available. If you are going to connect the matrix output to a single-ended audio device (one with RCA or phono connectors), then use the + of the left, + of the right, and ground. On the other hand, if you will be connecting the output to professional audio gear it is best to use the differential + and – (balanced) outputs of each side that offer immunity to noise.
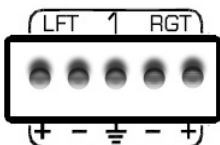
 Figure 4 – Typical balanced audio output connector

The balanced audio outputs are provided on detachable screw-terminals. Mating connectors for all outputs are also provided.

2.3 Power input connection

The matrix has a built-in universal power supply. The AC input connector on the rear of the matrix is an IEC320 / C6 and is always shipped with a North American power cord (shown below). If you want to use the matrix in a country with different plug type, you should purchase your own cable or adapter. The Matrix supports both 110 V, 60 Hz and 220 V, 50 Hz power systems. There is a power on indicator light on the front panel

 Figure 5 – End of IEC320 / C6 power cord

2.4 Control Inputs

The matrix can be controlled from either RS-232 or through IP.

2.4.1 Matrix with RS-232 Control (no IP)

The AC1120A and AC1122A (without IP feature) actually have 2 separate and independent RS-232 control ports.

The main RS-232 port is on a screw terminal and the auxiliary port is on an RJ45.

Caution on RJ45 Control Input

Since the matrices with the IP control and those without both have an RJ45 connector next to the RS-232 screw terminal, it is easy to confuse their function. The function of the connector should be labeled above it. A sure way to tell if the RJ45 control input is LAN or Serial is by the existence of little LED indicators to the sides of the connector. If the connector has these lights, then it is a LAN connection, otherwise it is an RS-232 serial connection.
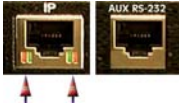
Figure 6 – IP input versus Auxiliary RS-232

2.4.1.1 Primary RS-232 Control Port

This is a 3-terminal captive screw input. A detachable mating connector is provided. The function of each pin is designated on the panel above the connector. Below is a diagram for connection this port to a PC's DB9 serial port.
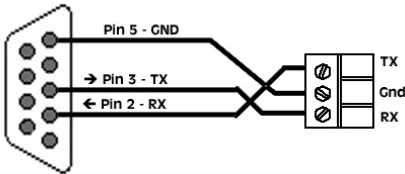
Figure 7 – Primary RS-232 to PC cable

2.4.1.2 Auxiliary RS-232 Control Port

The matrix switches without IP control have a secondary serial port that can work independently of the primary port. The user can control the matrix from either or both ports.

The auxiliary RS-232 is on an RJ45. **Make sure to not connect this to any LAN devices.** The pinout for the auxiliary RS-232 follows the basic EIA-561 for TX RX and Ground. Optional current limited 12v DC may also be provided (max rated output current of 50ma) that can be used to power external keypads or control devices.

Caution High-Voltage

Never open the unit's cover. Lethal voltages exists inside the unit
Opening the unit also voids the warranty on the unit.

The pinout is shown below.
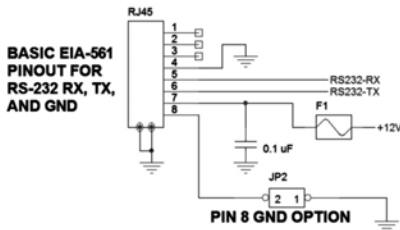
Figure 8 – Aux RS-232 port pinout

2.4.2 Units with IP control

Models AC1121A and AC1123A are equipped with 10/100 base-T Ethernet connection and can be controlled via IP. They also have the primary RS-232 serial control port on the screw terminal input. The command set for controlling the matrix via the IP port is exactly the same as the RS-232 port. The basic method of control is via Telnet. Please see section 3.2.12 IP Control Basics for details.

3.0 Operation

The Matrices can be operated using the front panel buttons, by serial commands via RS232, or through the IP port.

3.1 Front-Panel Buttons and Indicators

An image of the front panel for the 8x8 matrix is shown below. The 16x16 units have more INPUT and OUTPUT buttons than shown in this picture.

Figure 9 –AC1120A front panel controls & indicators

The front panel can be used for the following purposes:

- Monitor Power On/Off status
- View current routings (ties) either from input or from output
- Make new ties either from input or from output
- Blank or mute a particular or all outputs
- Recall preset patterns
- Save preset patterns
- Disconnect all ties
- Display current sound level as a digital light bar VU meter
- Recall factory presets

All of the front panel switches have built-in LEDs that help in the operation. The functions of front panel are carefully designed for intuitiveness. With just a little practice, one can learn to quickly monitor and control the matrix.

3.1.1 Viewing Audio and Video Routings or "Ties"

There are three different ways to view a tie: Video & Audio, Video only, or Audio only. The point of view can also be either from input side (where the selected input is routed to), or from the output side (see which input is feeding the selected output). You can also use the ▲ and ▼ buttons to quickly go through and check status of all channels. Furthermore, during viewing of ties you can make new ties.

3.1.1.1 Viewing ties by Video and Audio

Press and release both VID and AUD buttons so that the LEDs of the VID and AUD buttons are lit, which indicates that you are going to view both together.

At this point you have to decide if you want to view from the point of view of the input or the output side.

… To View from input side

Press and release any **Input** button, the backlit LED of that button will light, and all the backlit LEDs for the outputs whose video and audio are both currently tied to this input will also light up solid.

Note

If there is audio breakaway, the output LED will not be lit. An example may be that output #2 video is tied to input #7 while output #2 audio is tied to input 12. In this case if you start the viewing from input #7, output #2 will not be lit even though input 7 video is routed to it. To see video ties independently from audio ties, only the Video or the Audio LED on the front panel should be lit, not both.

You can now use the ▲ and ▼ buttons to quickly go through all inputs.

You can also make new ties by hitting output buttons. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

… To View from output side

Press and release any **output** button, the backlit LED of that button will light, and if that output's video and audio are tied to one particular input, that input LED will also light.

> **Note:** *If there is audio breakaway, the input LED will not be lit*

You can now use the ▲ and ▼ buttons to quickly go through all outputs.

You can also make new ties by hitting another input button. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

3.1.1.2 Viewing ties by Video only

Press and release the AUD and/or VID buttons so that the backlit LED of the VID button is lit and the AUD button is off

At this point you have to decide if you want to view from the point of view of the input side or the output side.

… To View from input side

Press and release any **Input** button, the backlit LED of that button will light, and all the backlit LEDs for the outputs whose video is currently tied to this input will also light up solid.

You can now use the ▲ and ▼ buttons to quickly go through all inputs.

You can also make new ties by hitting output buttons. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

… To View from output side

Press and release any **output** button, the backlit LED of that button will light, and if that output's video is tied to any input, that input LED will also light.

You can now use the ▲ and ▼ buttons to quickly go through all outputs.

You can also make new ties by hitting another input button. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

3.1.1.3 Viewing ties by Audio only

Press and release the AUD and/or VID buttons so that the backlit LED of the AUD button is lit and the VID button is off

At this point you have to decide if you want to view from the point of view of the input side or the output side.

… To View from input side

Press and release any **Input** button, the backlit LED of that button will light, and all the backlit LEDs for the outputs whose audio is currently tied to this input will also light up solid.

You can now use the ▲ and ▼ buttons to quickly go through all inputs.

You can also make new ties by hitting output buttons. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

… To View from output side

Press and release any **output** button, the backlit LED of that button will light, and if that output's audio is tied to any input, that input LED will also light.

You can now use the ▲ and ▼ buttons to quickly go through all outputs.

You can also make new ties by hitting another input button. New ties will not take effect unless ENTER is hit (see next section).

When you are done viewing ties, to exit you can hit ENTER. If you don't hit any buttons, then after 8 sec the view function times out and all the input and output LEDs will go out.

3.1.2 Making Audio and Video Routings or "Ties"

This procedure is an extension of "Viewing Ties" described in above paragraphs.

3.1.2.1 Making a tie by Input

Video and Audio to follow each other

Make sure both VID and AUD LEDs are lit, indicating that your changes will be synchronized (audio and video are together). Video and audio will be routed to the same input channel.

Press and release any **Input** button, the backlit LED of that button will light, and all the backlit LEDs for the outputs tied to it will light up solid. At this point, pressing any output buttons will be breaking or making connections.

To disconnect a tie, press the lit output button once. To make new ties, press any of the unlit output buttons. The output LED will be blinking to indicate a pending change of state. If you change your mind simply press the blinking output LED again and it will go back to its previous state.

When you are done, press ENTER to save new changes. If you wait too long (8 seconds of inactivity) your changes will be lost and all the input and output LEDs will go out.

Video only or Audio only

Press and release the AUD and/or VID buttons so that the backlit LED of the desired button is lit and the other one is off.

Follow the same procedure as described above

3.1.2.2 Making a tie by Output

Video and Audio to follow each other

Make sure both VID and AUD LEDs are lit, indicating that your changes will be synchronized (i.e. audio and video are from the same input).

Press and release any **Output** button, the backlit LED of that button will light, and all the backlit LEDs for the input tied to it will light up solid. At this point, pressing any output buttons will be breaking or making connections.

To disconnect a tie, press the lit input button once. To make a new tie, press any of the unlit input buttons. The new input LED will be blinking to indicate a pending change of state. If you change your mind simply press the blinking input LED again and it will go back to its previous state.

When you are done, press ENTER to execute and save the changed route. If you wait too long (8 seconds of inactivity) your changes will be lost and all the input and output LEDs will go out.

Video only or Audio only

Press and release the AUD and/or VID buttons so that the backlit LED of the desired button is lit and the other one is off. Follow the same procedure as described above.

3.1.3 Recalling Presets (routing patterns)

The number of presets accessible from front panel is the same as # of inputs (however through the IP or Serial port, the unit can store and recall up to 16 presets even for an 8 input Model)

Press and release the Preset button. The button will light up solid. Then press and release the input button (it will light up) and hit ENTER. You have 8 seconds to hit ENTER or the action will be cancelled. This will recall the desired preset tie pattern.

Note that a recalled preset replaces the current tie configuration, which will be lost unless it has been stored as another preset.

3.1.4 Saving Presets (routing patterns)

The current tie configuration can be saved as a preset to be called up later on.

To save the current AV routing pattern, press and hold the PRESET button for 3 sec, the backlit LED will start flashing (this means that save preset function has been activated). Press the desired input button to save the preset (the button with light up). Then hit the ENTER button to complete the operation. Again, you have 8 seconds to complete this sequence.

3.1.5 Disconnecting all AV outputs (blank preset)

There is a hidden blank preset (think of it as Preset #0) in the system that can be very useful in clearing all ties. A blank preset is a preset without any ties selected in it. To Recall a blank preset, press and release the Preset button, press and hold the ARROW UP (▲) button, and simultaneously press the ARROW DOWN (▼) button. This will clear all ties. From here, the user can make new ties or save the blank tie over a preset that had ties in it which effectively erases that preset.

3.1.6 To reset system to factory defaults

Disconnect the AC power from the unit. Press and hold the ENTER button on the front panel while plugging in AC power. Continue to hold the ENTER button until all LEDs on the front panel flash on. System reset clears all ties, presets, schedule settings, and unit name.

3.1.7 Using the Front Panel VU meter

This function is useful for ensuring no noticeable volume difference among the audio sources for models AC1121A and AC1123A.

Press and hold the AUD button for approximately 3 seconds until the backlit LED starts to blink. Press and release an input button whose audio you want to adjust.

The associated input LED lights up, the matrix will temporarily route the audio input from the selected channel to audio output #1 and monitor its level on the front panel. Any other outputs tied to this selected input channel stay connected during this adjustment procedure.

The installer can connect an external VU meter to output #1 or rely on the front panel (bottom row of lights) that act as a digital VU meter.

Notes about VU Meter Function

The front panel VU meter function is available on both the 16x16 and the 8x8 units with audio. However, the matrices do not change the volume level. The user can do that at the source and use the matrix to monitor the level. The bar indicator is for the left input (tip on mini-phono input) channel only. So when adjusting a stereo level make sure the left and right audio inputs are balanced

The bottom row of 8 or 16 LEDs indicate the sound level. Position 10 (or 5 for 8x8 matrix) is used to correspond to 0 VU (desired peak level).
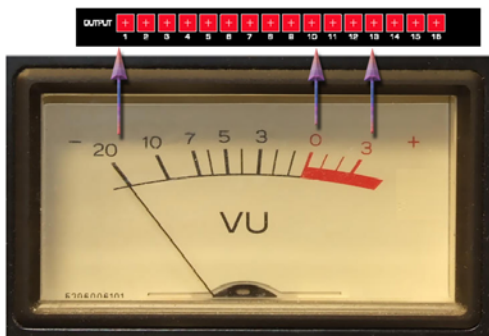
Figure 10 –Comparison with Analog VU meter on 16x16 Matrix
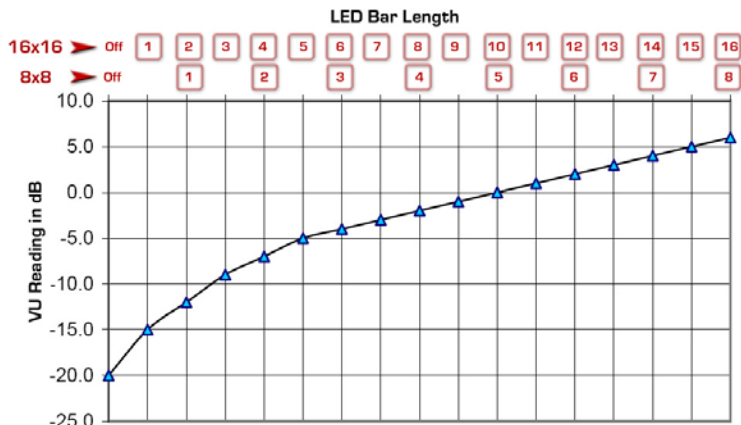
Figure 11 – Graph of VU dB level versus LED bar length

3.2 Control Commands (RS-232 and IP)

The matrices can be controlled via an external control system by using RS-232. Additionally, Models AC1121A and AC1123A can be controlled through an IP port. Any program capable of standard serial communication in ASCII format is capable of working with the matrices. Most PCs with Microsoft Windows operating systems have HyperTerminal™ pre installed with this capability. There are also many free Terminal Emulator and Telnet software programs available for download on the internet.

Note on RS-232 port availability on your PC

Most PCs and notebooks do not have a serial port. So to program the Matrix Switch you may need a USB to RS-232 Serial converter. These are available from Black Box (Model IC199A-R3).

Figure 12 – USB to RS-232 Adapter

Use Figure 8 to connect the unit to the PC's serial port. Use 9600 Baud, 8 bits, No Parity, 1 Stop bit, No flow control.

Upon power up, the matrix will output a screen similar to the figure below through its serial port(s).

Unit's name:

Version 2.3

Build # 7

BBox-I-A-8-8

Figure 13 – Power on screen

Note on RS-232 commands

When the front panel is in use (for example to make new ties or recall presets, etc), only status request commands are accepted. Any other command will be prompted with the following response:

Front panel is in use<cr>

Fortunately, all front panel operations have a timeout function so even if a user started to use the panel but forgot to finish the process, it will time out in a few seconds and full serial port functionality will be restored.

3.2.1 Naming Functions

The matrix unit can be named. Its name can be up to 10 characters long.

To assign or retrieve a unit name:

Command: NU<cr>   stands for Name Unit

Response:

xxxxxxxxxx (current name)

Rename unit: _____

No change<cr>

If you hit <cr> or wait 5 seconds (command times out) the unit will respond with:

Cancelled<cr>

Otherwise you have 5 seconds to change the name by entering up to 10 ASCII characters followed by <cr>. If you just send a <cr> then the stored name will not be changed. If you enter more than 10 characters, then the 1st 10 characters will be saved as the name and the rest discarded.

3.2.2 Routing Functions

Video routing commands are specified from the point of view of the output. The wildcard character '*' is acceptable for output (but not input).

In addition, these commands can be used to monitor or query the status of system ties. Omitting the input channel will result in a response of the current routing for that output. In entering channel numbers leading zeros are acceptable hence you can specify channel 7 as 07 or just 7.

3.2.2.1 To make a video tie:

Command: CVn,m<cr>   stands for Connect Video n = output, m= input (unit accepts leading zeros and spaces are ignored)

Response: CVn,m<cr>

If you enter CVn<cr> then you will get the response as above for the n output

3.2.2.2 To make an audio tie:

Command: CAn,m<cr>   stands for Connect Audio n = output, m= input (unit accepts leading zeros and spaces are ignored)

Response: CAn,m<cr>

3.2.2.3 To make a synchronized audio/video tie:

Command: COn,m<cr>   stands for Connect Output n = output, m= input (unit accepts leading zeros and spaces are ignored)

Response:

CAn,m<cr>

CVn,m<cr>

Note: If the system does not have audio, it will still accept this command but response will be missing audio tie line.

3.2.3 Preset Pattern Saving and Routing Functions

3.2.3.1 To recall a saved preset Video routing pattern:

Command: PRx<cr>   stands for Preset Recall

x = preset # can be 1 to 16

Response:
PRx<cr>
CVn_1,m_1<cr>
CVn_2,m_2<cr>

3.2.3.2 To save the current Video routing pattern to a preset:

Command: PSx<cr>   stands for Preset Save
x = preset # can be 1 to 16 (unit should accept leading zero)
Response:
PSx<cr>

3.2.4 Restoring Factory Defaults

To restore factory defaults:

Command: FR<cr>   stands for Factory Restore

Response: Are you sure (Y,N)?<cr>
        Note: You have 5 seconds to press Y, or the command is cancelled.
Factory defaults restored<cr>   *if the "Y" was entered.*
Cancelled<cr>   *if other key was entered or command times out.*
Note: Restore Factory command will clear all ties, presets, schedule settings, and unit name. All LEDs on the front panel should flash when units executes factory defaults command.

3.2.5 Rebooting the System

To perform a system reset/reboot (same effect as cycling AC power):

Command: FB<cr>   stands for Firmware Boot
Response:

Are you sure (Y,N)?<cr>
        Note: You have 5 seconds to press Y, or the command is cancelled.

3.2.6 To Read Audio Volume Units (VU) of output #1

This command returns the height of hypothetical bar LED indicator having a height of 16 segments. It will return a number from 0 to 16 with 10 being 0 db level. So if the output #1 is at 0 dB (900 mv p-p sinewave) it returns 10. See figure 11 for 16x16 row. This value is 0-16 regardless of the type of matrix.

Command: RB<cr>   stands for Read Bar
Response: 0 ~ 16<cr>

3.2.7 To Read Temperature inside the Matrix

Command: RT<cr>   stands for Read Temperature
Response:
Temperature in degrees C = 32.500000<cr>
Temperature in degrees F = 90.500000<cr>

3.2.8 To Read the Firmware Version

Command: RI<cr>   stands for Read Identity
Response:
Unit's name: ← *User defined name of the unit*
Version 2.3   ← *Firmware Version*
Build # 7   ← *Build number (for mfg purposes only)*
BBox-I-A-8-8   ← *Characteristics of the unit*

3.2.9 To Read Supply Voltages

The supply voltages consist of clock battery voltage, 5V supply, and 12V supply.

Command: RV<cr>   stands for Read Voltages
Response:
RTC Battery Voltage = 2.9876704
+5V Supply = 4.9473252
+12V Supply = 12.4646893

3.2.10 Real Time Clock Functions

3.2.10.1 To set date & time:

Command: DS<cr>   stands for Date Set
Response:
Friday 04/18/08 12:27:15pm

Enter the year (00-99):   *Hit Enter if you want to keep previous value; hit Esc to exit*
Enter the month (01-12):
Enter the date (01-31):
Enter the day of the week (1=Sun – 7=Sat):
Enter the hour (1-12):
Enter the minute (00-59):

Enter the second (00-59):
Enter AM/PM (0-1):
Notes: *You have 16 seconds to make your selection, or the command is cancelled. To skip the current prompt without making a change, press ENTER.*

Invalid entry<cr>
Cancelled <cr>   *if invalid value was entered.*
Cancelled <cr>   *if ESC was entered.*

3.2.11 Scheduling Auto recall of Preset Patterns

The matrix provides up to 4 specific times throughout the day where any preset patterns (0 to 16) can be recalled. You can set a schedule that is the same every day (daily) or is different for weekdays and weekends. Presets 1 to 16 are those saved by the user, and preset 0 disconnects all video and audio outputs

Notes on Scheduling Presets

When defining a schedule, to skip the current prompt without making a change, press ENTER. Press ESC to exit the schedule setting at any time. Timer values should be entered in the proper order meaning that Timer1 should occur prior to Timer2, Timer2 should occur prior to Timer3, and etc. Timers will be disabled if hour, minute, and AM/PM are set to 0. So if for example, your schedule only has to set the pattern once in the morning, leave the data for timers 2 through 4 at zero and only enter values for timer 1. If Timer values are not set properly (in ascending order), an error message will be prompted

3.2.11.1 To set a schedule

Command: SS<cr>   stands for Schedule Set (current schedule is displayed)
Response:

------------------ Weekday ------------------ (on/off)
Timer1 = 06:00am   Preset Pattern = 1
Timer2 = 12:05pm   Preset Pattern = 3
Timer3 = 05:30pm   Preset Pattern = 7
Timer4 = 09:00pm   Preset Pattern = 12

------------------ Weekend ------------------ (on/off).
Timer1 = 02:00am   Preset Pattern = 1
Timer2 = 06:00am   Preset Pattern = 5
Timer3 = 12:00pm   Preset Pattern = 13
Timer4 = 06:00pm   Preset Pattern = 16

Select Schedule Setting
   1   = Weekday
   2   = Weekend
   3   = Daily

- ❑ (on/off) indicates if the Schedule is in-effect or not.
- ❑ Weekday and weekend are both on or both off.
- ❑ If the 4 timers are not in ascending order, the unit does not let you turn the schedule on; fix any inconsistencies before turning on.
- ❑ 00:00am is not a valid time setting and is used to turn off a timer

4   = Schedule On
5   = Schedule Off
ESC = Quit

Note: You have 16 seconds to make your selection, or the command is cancelled.

Response: *if "1", "2" or "3" was entered*
Enter weekday Timer1 hour (00-12):   *Hit Enter if you want to keep previous value*
Enter weekday Timer1 minute (00-59):
Enter weekday Timer1 AM/PM (0-1):
Enter weekday Timer1 preset pattern (0-16):   *Remember Preset 0 disconnects outputs*
.
…… (data for timers 2 & 3, hit Esc if you are done at any time)
.
Enter weekday Timer4 hour (00-12):
Enter weekday Timer4 minute (00-59):
Enter weekday Timer4 AM/PM (0-1):
Enter weekday Timer4 preset pattern (0-16):

Response: *if "4" was entered (schedule on).*
Schedule setting is ON<cr>
- - - - - Alternate Response: *In case of an inconsistency or error in entry*
Schedule setting cannot be ON because weekday (weekend) TimerX is less than
or equal to TimerY<cr>

Response: *if "5" was entered (schedule off).*
Schedule setting is OFF<cr>.

Response: *if "ESC" was entered (Quit).*
Quit schedule setting<cr>.
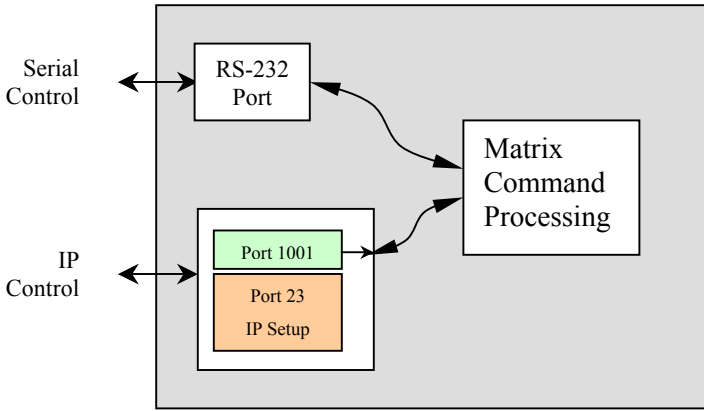
3.2.12 IP Control Basics

Figure 14 – Control Block Diagram

As shown in the figure above, the matrix can be controlled via RS232 Serial port or through an IP (Ethernet) port if equipped. If the unit is missing the IP port, then in its place, there is an auxiliary 2nd serial control port (see section 2.4.1).

The IP port of the matrix can be accessed via Telnet (interactive TCP connection). Two ports are available, one for controlling the matrix and the other to configure the IP parameters.

Though not recommended, using port 23 you can change the Ethernet interface's IP parameters such as IP address, gateway, port number, etc. The IP settings can also be accessed through the unit's RS232 serial port (recommended).

Port 1001 by default is used to control the matrix (this port number can be changed as part of the IP Settings). The commands used to control the matrix are the same as those through the RS-232 Serial port.

3.2.12.1 IP Setup Commands using the RS-232 Serial Port

IP interface on the matrix has a unique MAC-address, and it must be assigned a valid IP-address to function properly on the network. As shipped from factory this IP is 192.168.123.180

1. To get into the IP setting mode:

Note: Inactivity period of 16 seconds causes the system to exit this mode. You can also hit ESC to end the IP setting mode.

Command: IP <cr>   stands for IP setting mode
Response:
Enter IP commands:

This is the normal response meaning that IP setting through the RS-232 port is allowed
 - - - - - Alternate Response - - - - -
IP commands not enabled. Please refer to the manual
This message indicates that IP setting through the RS-232 port is disabled on your unit for some reason. Please refer to section 3.2.12.2 below to enable this mode

2. To get the current IP address of the matrix box:

Command: GIP <cr> stands for Get IP address.
Response: 192.168.123.180

3. To set a new IP address:

Command: SIP192.168.123.179 <cr> stands for Set IP address.
Response:
OK ....*if command completed successfully.*
Error.. *if command failed.*

4. To get the current gateway IP address:
Command: GGI <cr> stands for Get Gateway IP address.
Response: 192.168.123.122

5. To set a new gateway IP address:

Command: SGI192.168.123.125 <cr> stands for Set Gateway IP address.
Response:
OK ....*if command completed successfully.*
Error.. *if command failed.*

6. To get the current subnet mask:

Command: GNM <cr> stands for Get Net Mask.
Response: 255.255.255.0

7. To set a subnet mask:

Command: SNM255.255.255.0 <cr> stands for Set Net Mask.
Response:
OK ....*if command completed successfully.*
Error.. *if command failed.*

8. To get the current port number (this is the port to access the matrix):

Command: GPN <cr> stands for Get Port Number.
Response: 1001

9. To set a port number (IP port that controls the Matrix):

Command: SPN1000 <cr> stands for Set Port Number.
Response:
OK ....*if command completed successfully.*
Error.. *if command failed.*

10. To get a device/host name:

Command: GDN <cr> stands for Get Device Name.
Response: BB1123-A

Note on Device Name

This is the host name assigned to the IP port; it is independent of the name assigned to the matrix (NU command), though you can use the same name if you wish!

11. To set a device name:

Command: SDNnew_name <cr> stands for Set Device Name.
Response:
OK ....*if command completed successfully.*
Error.. *if command failed.*

12. To reboot the system for the changes to take effect:

If you change the IP address, Subnet mask, etc., the changes do not take effect unless you reboot the unit. You can do this by unplugging the AC from the unit and reconnecting it in a few seconds, or by using the FB command discussed earlier. However you must first exit the IP setup mode by hitting Esc,

3.2.12.2 IP Configuration through port 23

If you were unable to enter the IP setting mode through the serial command, a Telnet TCP programming method can be used to turn on RS-232 serial mode programming, or even to configure the network settings directly through port 23.

To open a Telnet section, a command prompt (Run: CMD) or a HyperTerminal window can be used:

For example, to run a HyperTerminal window, set it up for TCP/IP connection on PORT 23 along with the Matrix's default IP address as the host address.

Telnet commands and replies have the following format:

STX	Command/reply	CR

- STX character (ASCII code 2 or CTRL-B from the keyboard)

The unit will respond with <CTRL-B> A for most valid commands.

1. To use the IP configuration Telnet commands, you must first log in using the (L) command.

Command: <CTRL-B> L <CR>   stands for Log in

2. To enable a serial IP setting (serial programming) mode, type the following commands:

Command: <CTRL-B> SSE2 <CR> Stands for Set Serial Enable

Command: <CTRL-B> SEC6 <CR> Stands for Serial Enable Char

Command: <CTRL-B> O <CR>   stands for log out

Reboot the system by cycling power. Now you should be able to configure IP parameters through the IP port.

Alternatively instead of rebooting the system you could use <CTRL-B> <E> <CR>   to reboot the IP port, this may cause a momentary loss of Telnet connection.

3. To get the current IP address:

Command: <CTRL-B> GIP <CR>
Response: <CTRL-B> A 192.168.123.180 <CR>

4. To set a new IP address:

Command: <CTRL-B> SIP192.168.123.179 <CR>

5. To get the current gateway IP address:

Command: <CTRL-B> GGI <CR>
Response: <CTRL-B> A 192.168.123.122 <CR>

6. To set a new gateway IP address:

Command: <CTRL-B> GGI192.168.123.125 <CR>

7. To get the current subnet mask:

Command: <CTRL-B> GNM <CR>
Response: <CTRL-B> A 255.255.255.0 <CR>

8. To set a subnet mask:

Command: <CTRL-B> SNM255.255.255.0 <CR>

9. To get a port number:

Command: <CTRL-B> GPN <CR>
Response: <CTRL-B> A 1001 <CR>

10. To set a port number:

Command: <CTRL-B> SPN1000 <CR>

11. To get the current device name:

Command: <CTRL-B> GDN <CR>
Response: <CTRL-B> A BB1123-A <CR>

12. To set a new device name:

Command: <CTRL-B> SDNconcert_hall <CR>

13. To Reboot device for the new parameters to take effect:

Command: <CTRL-B> E <CR>
Response: none!   May lose connection

14. To log out :

Command: <CTRL-B> O <CR>
Response: <CTRL-B> <CR>

Note on IP Settings through port 23

If you are unable to access the unit's port 23 from your PC using the matrix's default or last known IP address, it could be that the IP address of the matrix is not compatible on your LAN. One way around this is to connect your PC directly to the Matrix's IP port using a cross over cable, or use a switch or router not connected to anything else but your PC and the Matrix, Then configure your PC for a static IP compatible with the current address of the matrix. If the matrix has the factory default of 192.168.123.180, a PC address of 192.168.123.nnn may be entered where nnn is any number except 180.
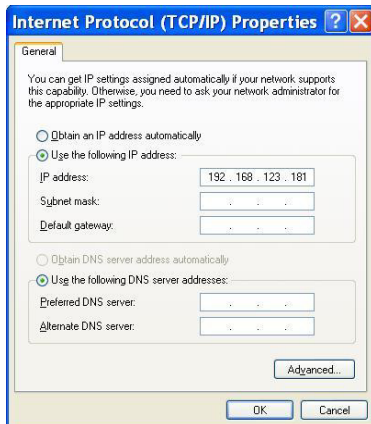
Note on Accessing the Matrix via the Internet

It is best to contact your IT or network administrator for assistance. As mentioned earlier you can control the matrix through its IP via port 1001 (default). Most likely the unit will be on a local network connected to an Ethernet Switch or Router with a WAN connection. To access the matrix from outside your local network, you should configure the Ethernet Switch or Router to treat the IP and port assigned to the matrix as a virtual server this is a setting of your switch or router. Then you can access the matrix from anywhere on the internet via your WAN address and assigned port. It is advised to set the matrix's Gateway address the same as your Ethernet switch or router's Gateway IP address. In case of trouble please contact your IP administrator for assistance.

4.0 Maintenance and Troubleshooting

4.1 Maintenance

The front panel CHECK button LED starts flashing if one of the following conditions occurs:

- RTC Battery Voltage is below 2.4V

- +5V Supply is outside of normal operating range 4.5V – 5.5V

- +12V Supply is outside of normal operating range 10.8V – 13.2V

- System temperature is exceeding 122° F (50° C)

If the battery needs changing, please contact Black Box (during the warranty period).

Caution High-Voltage

Never open the unit's cover. Lethal voltages exists inside the unit
Opening the unit also voids your warranty.

If there is a problem with the 12 or 5v supplies, you need to return the unit for repair. Please see next section. If the temperature is excessive in the unit, you must make sure that there is adequate air flow around the unit.

4.2 Troubleshooting

Make sure that all your connections are solid, and check the state of the LED's on the front of the unit. Do not open or try to repair the unit yourself. There is no customer repairable item in the unit and you will void your warranty.

4.2.1 Calling Black Box

If you determine that your unit is malfunctioning, do not attempt to repair the unit. Contact Black Box Tech. Support at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- The nature and duration of the problem;
- The components involved in the problem
- The results of any testing you've already done.

4.2.2 Shipping and Packaging

If you need to transport or ship your matrix:

- Package it carefully. We recommend that you use the original container.
- Before you ship the unit back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

5.0 Specifications

Video Inputs	8 or 16 HD15 female connectors
Video Outputs	8 or 16 HD15 female connectors
Resolutions Supported	PC resolutions up to 1900x1200 @ 60 Hz & HDTV to 1080p
Video Levels	-0.3v to 0.7v (1 V p-p) on RGB, 0 to 5v DC on Sync
Audio Inputs	Unbalanced Stereo.
Audio Input Levels	0 to +4dBu (0.78 to 1.23Vrms) line level
Audio outputs	Balanced Stereo on screw terminals.
Audio Bandwidth	10 Hz to > 10 MHz (could pass through analog or digital S/PDIF audio sources)
Temperature	Operating: 32 to 122°F (0 to 50°C); Storage: –40 to +185°F (–40 to +85°C)
Enclosure	Steel with Aluminum front panel
Battery Type	CR2032 (3v Lithium)
MTBF	90,000 hours (calculated estimate)
Power	100VAC-240VAC 50/60Hz.
Size	3.5" High x 19" Wide 12.78" Deep
Weight	9.4 pounds

Appendix 1 – Front Panel Quick Reference Guide

Figure 15 – Control buttons on the front panel

Function	Procedure
View ties or Make ties	❑ Hit VID and/or AUD buttons to light desired
	❑ Hit any of the INPUT or OUTPUT Buttons
	❑ To change ties, hit any INPUT or OUTPUT then hit ENTR
	❑ Use ▲ and ▼ buttons to quickly scroll
Recall Presets	❑ Hit PRE (button lights up)
	❑ Hit any of the 16 INPUT buttons
	❑ Hit ENTR
Save Presets	❑ Hold PRE until it starts blinking
	❑ Hit any of the 16 INPUT buttons
	❑ Hit ENTR
Disconnect all outputs	❑ Hit PRE (button lights up)
	❑ Hold ▲
	❑ While holding the ▲, hit ▼ button
Reset to Factory Defaults	❑ Disconnect power
	❑ Hold ENTR
	❑ While holding ENTR, plug power

Appendix 2 – Command Summary

Command	Function
COn,m	Connect Output (both A&V). n = output, m= input
	❑ Omitting ,m will show current connections
	❑ Substitute * for n to tie all outputs
CVn,m	Connect Video output. n = output, m= input
	❑ Omitting ,m will show current connection
	❑ Substitute * for n to tie all outputs
CAn,m	Connect Audio output. n = output, m= input
	❑ Omitting ,m will show current connection
	❑ Substitute * for n to tie all outputs
PRx	Preset Recall... x = preset # can be 1 to 16
PSx	Preset Save ... x = preset # can be 1 to 16
NU	Name Unit
FR	Factory Restore (back to default settings)
FB	Firmware Boot (Resets the entire system)
RT	Read Temperature
RI	Read Identity (firmware version, & characteristics)
RV	Read Voltage levels (battery, power supply)
RB	Read Bar (reads VU level of output #1 Left Chan)
DS	Date and Time Set
SS	Schedule Set
IP	Access or change IP settings of Matrix
	❑ GIP (get IP) SIP (set IP)
	❑ GGI (get Gateway) SGI (set Gateway)
	❑ GNM (get Net Mask) SNM (set Net Mask)
	❑ GPN (get Port No.) SPN (get Port No.)
	❑ GDN (get Dev Name) SPN (set Dev Name)

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